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Clear as water: Measuring the visibility of ocean research literature topics using citations, social media, news, and policy mentions

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Context and Objectives

In 2017, the United Nations General Assembly proclaimed the UN Decade of Ocean Science for Sustainable Development Oceans (2021-2030) as a common framework for integrating research-based knowledge in ocean governance and action (UNESCO, 2017). However, little is known about how expert knowledge and research outputs actually translate into the general public awareness of oceans.

This study examines the citations, Twitter, Wikipedia, policy, and news mentions received by documents representing a broader set of ocean-related research outputs. Ultimately, our objective is to compare the attention received by various topics across indicators. This will help understand how expert knowledge is integrated in our representation of ocean issues, as well as highlight potential knowledge or attention gaps toward certain topics.

Document collection and clustering

Building on an analysis of the *Second World Ocean Assessment* (WOAII) report (United Nations, 2021), a broad knowledge synthesis about the state of the oceans produced through the UN (Evans et al., 2021). we first manually extracted **4,723 references** from the report. We then collected metadata from Crossref and OpenAlex (Priem et al., 2022) from the references with DOIs, and linked these through citations to a broader body of literature available on OpenAlex (Toupin et al., 2024a). We finally developed a process to identify the research outputs most closely related to ocean-related topics (Toupin et al., 2024b). This resulted in a dataset of **85,789 references**, which were separated by chapters based on their “best fit”.

Indicator analysis and processing

Citations were collected on **OpenAlex**, and we then collected Twitter, Wikipedia, policy, and news mentions document-level count using the **Altmetric API**. Altmetric records were collected through DOIs for **52,597 references** (**Figure 1**). We then looked at the distribution of indicators at the chapter level (**Figure 2**) and calculated z-scores comparing indicator levels (**Table 1 and Table 2**).

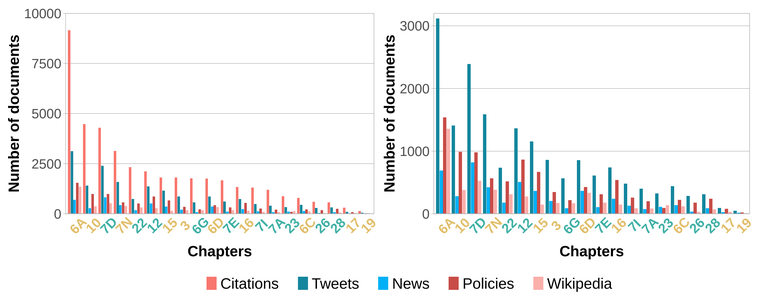

Figure 1: Number of documents with at least one indicator linked to the top 10 and bottom 10 chapters in overall altmetric z-scores

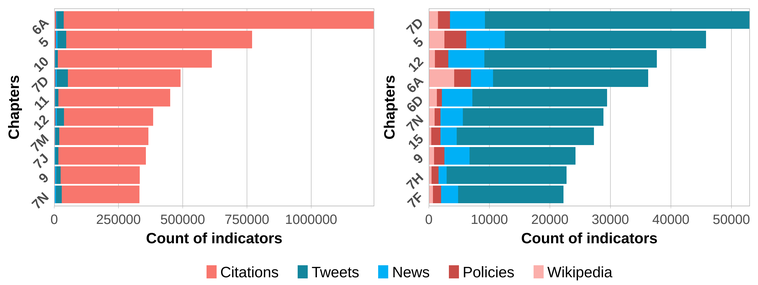

Figure 2: Distribution of indicators in the top 10 chapters per all indicators count (left) and altmetrics (count)

Chapter	Chapter title	N of documents	N of papers	Z-Scores					
				Citations	Tweets	Wikipedia	Policies	News	All altmetrics
6D	Marine mammals	1756	1651	0.17	2.62	1.05	0.20	2.78	2.26
16	Changes in aquaculture	1329	1260	0.65	2.14	0.80	1.28	2.02	1.96
12	Changes in inputs and distribution of solid waste, other than dredged material, in the marine environment	2118	2021	2.32	1.57	0.72	1.95	1.82	1.91
6C	Fishes	795	757	1.24	1.21	4.05	0.84	0.31	1.90
23	Developments in the exploration for and use of marine genetic resources	870	845	1.21	0.63	2.46	-1.37	-0.26	1.43
15	Changes in capture fisheries and harvesting of wild marine invertebrates	1812	1740	-0.59	1.34	-0.28	1.12	-0.01	1.15
28	Developments in the understanding of overall benefits from the ocean to humans	572	531	2.86	0.79	0.40	3.57	-0.64	1.12
7D	Tropical and subtropical coral reefs	4285	4081	0.18	1.06	-0.01	0.39	-0.14	0.97
3	Scientific understanding of the ocean	1811	1736	0.37	0.85	-0.09	-0.23	0.57	0.95
7N	Open ocean	3130	2998	0.01	0.32	-0.28	-0.51	0.53	0.91

Table 1: Z-scores per indicator for the top 10 and bottom 10 chapters in term of overall altmetric z-scores

Preliminary findings

- The volume of citations to documents identified with ocean-related research and linked to literature referenced in the WOAII is significantly higher than other indicators. Tweets appear to be the second-most prevalent indicator, followed by news mentions, policy mentions and Wikipedia mentions (**Figure 2**).
- The documents linked to **Chapter 6C** (Fishes), **6D** (Marine mammals), **12** (Changes in inputs and distribution of solid waste, other than dredged material, in the marine environment), and **16** (Changes in aquaculture) display the **highest** levels of attention (**Table 1**).
- At the other end, the documents linked to **Chapter 10** (Changes in nutrient inputs to the marine environment), **19** (Changes in hydrocarbon exploration and extraction), **22** (Invasive species), and **26** (Developments in marine spatial planning) show the **lowest** levels of attention (**Table 2**).
- At the scale of individual indicators, documents linked to Chapter **28** (Developments in the understanding of overall benefits from the ocean to humans) show the **highest level** of attention based on **citations** and **policy mentions**.
- Documents linked to **chapters 6D** and **16** display high levels of attention in **tweets** and **news media**, while **chapters 6C** and **23** (Developments in the exploration for and use of marine genetic resources) display high level of attention on **Wikipedia**.

Chapter	Chapter title	N of documents	N of papers	Z-Scores					
				Citations	Tweets	Wikipedia	Policies	News	All altmetrics
7I	Salt marshes	1304	1251	0.64	-1.05	-0.42	-0.20	-0.47	-1.02
26	Developments in marine spatial planning	596	570	-1.51	-0.92	-1.42	-0.51	-2.26	-1.02
6A	Plankton	9147	8805	1.24	-0.98	0.27	-0.22	-0.91	-1.10
7E	Cold water corals	1663	1559	-0.84	-1.05	-0.71	-1.28	-0.24	-1.16
6G	Marine plants and macroalgae	1772	1683	-1.03	-1.01	-0.77	-0.92	-1.16	-1.19
7A	Intertidal zone	1194	1158	-0.64	-1.41	-0.83	-0.76	-1.34	-1.25
10	Changes in nutrient inputs to the marine environment	4474	4284	1.29	-1.28	-0.22	0.90	-0.88	-1.26
17	Changes in seaweed harvesting and use	305	275	-0.93	-1.30	-1.07	-0.41	0.36	-1.40
22	Invasive species	2323	2199	0.02	-1.24	-0.38	-0.38	-0.93	-1.42
19	Changes in hydrocarbon exploration and extraction	140	136	-1.18	-1.47	-1.42	-1.31	-1.12	-1.61

Table 2: Z-scores per indicator for the bottom 10 chapters in term of overall altmetric z-scores

References & Acknowledgements

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